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NASA TECH BRIEF

NASA Headquarters

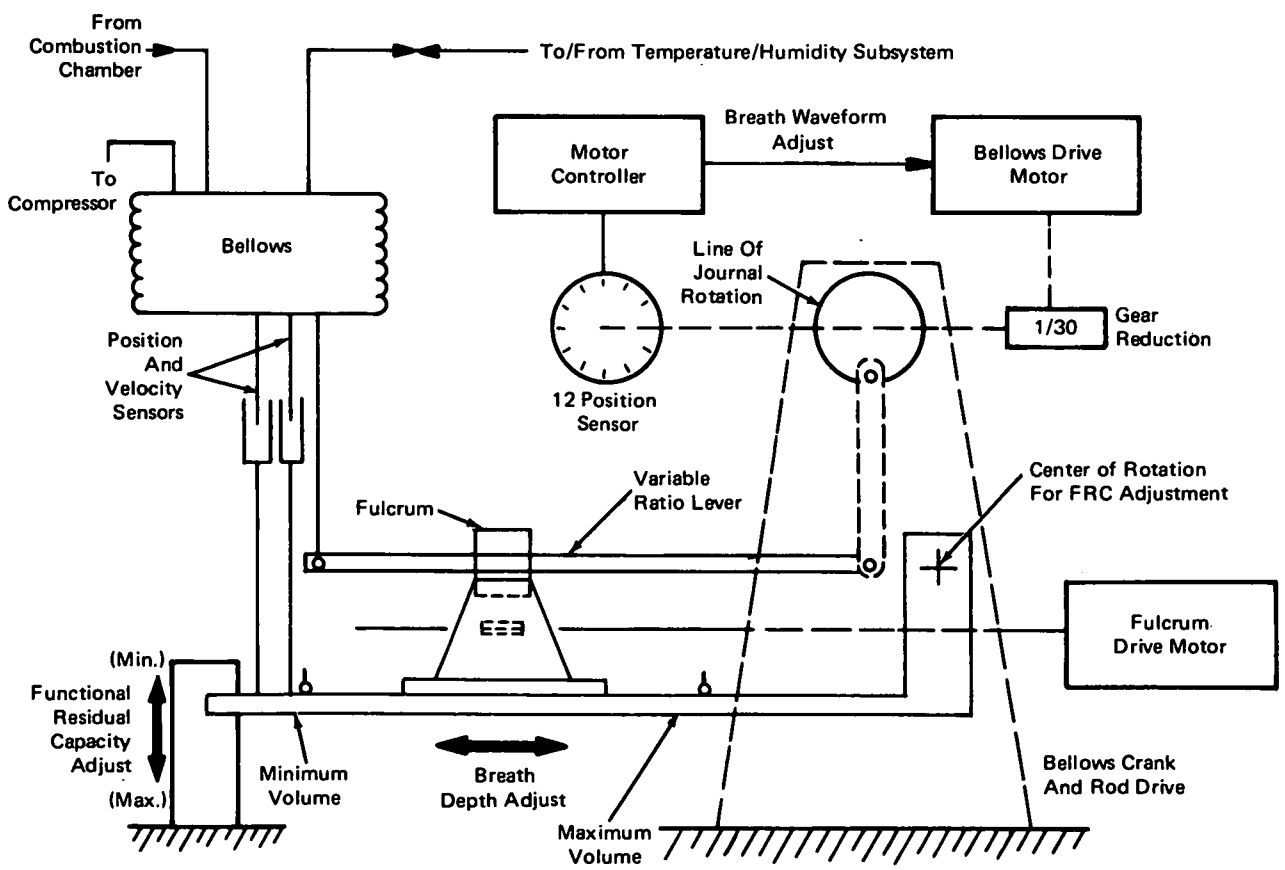
Drive Mechanism for Production of Simulated Human Breath

The problem:

Use of human subjects in evaluation of life support and resuscitation equipment involves many complications. Human subjects cannot provide steady performance, they vary from individual to individual, and they cannot be controlled at will. Therefore, it is best to use equipment which can simulate human breath.

The solution:

A simulated breath drive mechanism was developed as a subsystem to the breathing metabolic simulator (see Notes). The mechanism reproduces a complete range of human breath rate, breath depth, breath waveform as well as the independently controlled functional residual capacity.



(continued overleaf)

How it's done:

The breath drive mechanism, as shown in the figure, uses bellows to provide the breath function. The periodic motion of the bellows is accomplished by a bellows drive motor operating a crankshaft/connection rod combination through a 30:1 gear reduction. The drive motor speed is varied by a motor controller. Long term variations, greater than one crankshaft revolution, correspond to changes in breathing rate and are varied from a separate control unit. Short term variations, within a crankshaft revolution corresponding to changes in breath waveforms, are varied by the individual setting of 12 waveform controls on the control unit.

Connecting rod motion is transmitted to the bellows by means of a lever arm operating on a movable fulcrum. Fulcrum motion along the lever arm varies the lever arm ratio corresponding to changes in breath depth (volume). This motion is accomplished by means of a lead screw from the fulcrum drive motor which is in turn controlled by the bidirectional fulcrum switch on the control unit.

Fulcrum motion normal to the lever arm (i.e., moving the position of the bottom of the bellows for a fixed crank position and lever arm ratio) will change the minimum bellows volume obtainable through periodic motion. This corresponds to a functional residual capacity (FRC) adjustment and is controlled by a manual screw adjustment on the support for the fulcrum base.

The simulated breath mechanism has several features. First, the breath rate and breath depth may be remotely controlled as independent parameters through continuous ranges of values. Thus, an infinite number of simulated loadings may be selected without interruption of the test environment. And second, simulated functional residual capacity may be adjusted independently of other parameters through a continuous range. Thus, the mechanism can simulate various individual human breathing characteristics without any changes of parts.

Notes:

1. Additional information is contained in the following Tech Briefs: B72-10657 (HQN-10766), B72-10658 (HQN-10776), B72-10660 (HQN-10778), and B72-10661 (HQN-10779).
2. Requests for further information may be directed to:
   Technology Utilization Officer
   NASA Headquarters
   Code KT
   Washington, D. C. 20546
   Reference: B72-10659

Patent status:

NASA has decided not to apply for a patent.

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